Report of Climate Sub Group 2004

Climate Sub-group

(1) Objectives of the Climate Sub-Group

Regional climate information was only addressed to a limited degree in the third IPCC-2001 report. Coarse resolved GCMs simulate general circulation features well in general. At the regional scale, however, the models display area-average biases which are highly variable from region to region and among models.

We are going to provide scenarios of the likely climate change in precipitation, temperature and insolation around the Mediterranean region after the global warming, modeling studies are carried out using GCMs and regional climate models. Although the accuracy can not expected to be very high, we are going to make an effort to have the best result in the world. Interaction between land use and the regional climate is also studied by the regional climate models and data obtained by this project.

(2) MRI/JMA 20-km Mesh Atmospheric General Circulation Model

Ten-year simulations are performed with the 20-km mesh global AGCM for the present and future conditions, respectively. Due to increased resolution, synoptic scale atmospheric circulations are very well simulated together with orographic precipitation features. Different changes in precipitation and runoff between the Seyhan River Basin and mountain areas are interesting and need further investigations (see figures below).

These very high resolution model's results would be very useful for regional climate change assessment because the global model has no artificial boundaries that regional models must use. A limitation of time integration due to huge computational resource and non-existence of air-sea interaction are trade-offs.

Figure 1 shows the distribution of monthly precipitation during June 2000. The left is estimated by the downscale using RCM from the daily meteorological conditions given by MRI-CGCM-2 which corresponds to 250km grid interval. The right shows the precipitation estimated by the 20-km Mesh AGCM mentioned above. They cannot be compared directory because these are based upon the different GCM runs and each of them has different inter-annual variation. These two shows quite similar precipitation distribution which are affected by orography. The orographic effects on precipitation is slightly stronger in the RCM downscale experiment.

We have stored the monthly mean data for 117 selected variables and daily data for 5 variables (daily maximum surface air temperature, daily minimum surface air temperature, daily maximum surface wind speed, daily precipitation and daily maximum one-hour precipitation) for Turkey and the surrounding region for 10 year each for present and future for the use in the ICCAP project.

(3) Downscaling of climate change

The regional climate model was applied to the downscaling of the GCM products, which was obtained by MRI-CGCM-2 (Kitoh,2002). The regional model has been validated by comparison of distribution and variation of precipitation in Turkey. Downscaling were carried out for Jan, Apr, Jul and Oct during two decades: 1990's and 2070's. Predicted precipitation during 1990's are roughly agree with observation except for July. Range of inter-annual variation of the estimated precipitation also agrees with observation. In principal, predicted weather by GCM is different from that of the real earth, but the statistics of the weather (climate) must be similar to the real one. Inter-annual variation is not always agree to the real one even during past years.

Precipitation simulated during 1990's almost agree with observed one. The predicted precipitation during 2070's is about 30% smaller than that during 1990's. Predicted monthly mean precipitation during July is the level of only about 1/10 of the observation. Turkey is covered by a too strong anti-cyclone during July in the GCM products. In generally, one of the largest difficulty in the downscale process using a nested regional climate model, is the bias of GCMs, especially shift of a regional scale climate system may gives serious error in the nested model.

(4) Pseud warming

In generally, one of the largest difficulty in the downscale process using a nested regional climate model, is the bias of GCMs, especially shift of a regional scale climate system may gives serious error in the nested model. To avid this difficulty the boundary condition was assumed by a linear coupling of the re-analysis data (observation) and the trend component of the global warming estimated by GCMs. This assumption may valid when the trend of the global warming is small enough and allows neglecting the nonlinear

interaction between the trend and the inter-annual variation of the climate systems. By this method, prediction will approach to the simulation using re-analysis data when the difference of the global warming is small and allow to estimation of the difference by smaller number of ensemble of run. Downscaling by this method gives similar trends as the nested RCM directly derived by daily GCM products for monthly mean precipitation in January.

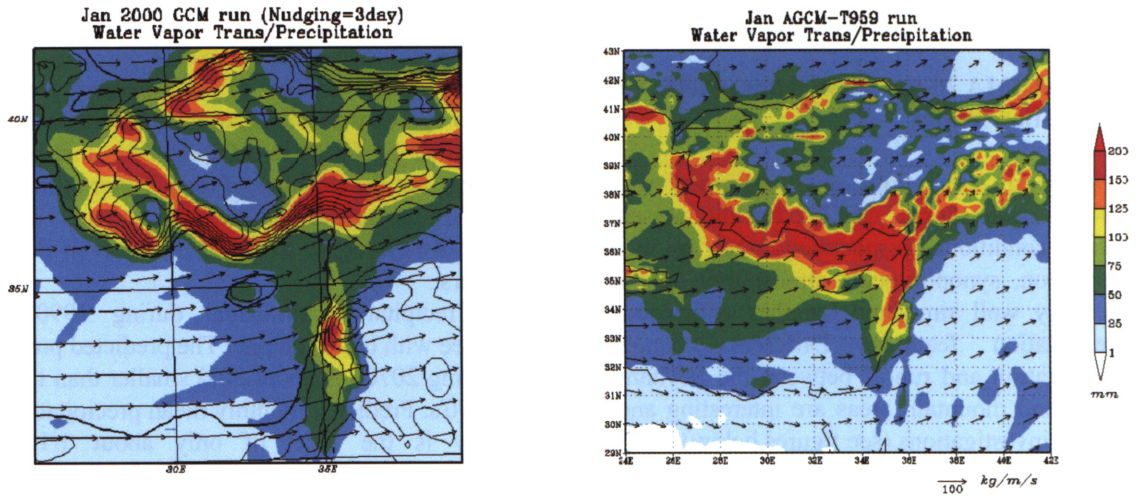
By some comparative numerical simulations using GCM data as input large scale data, the Pseud warming run gives similar trend as the direct downscaling by GCM during 10 years each in 1990s and 2070s.

(5) Distribution of Data set RCMPW-V2

Data set of RCM pseudo warming run ver. 2 have been distributed to all member of ICCAP. This data set includes the simulation run of RCM using NCEP/NCAR boundary conditions and pseud warming run (in 1999 + 80). The data set includes three hourly precipitation, temperature, wind velocity and downward short wave radiation (insolation) at the observation stations in the entire Turkey (537 stations).

(6) An analysis of grid precipitation data set

Using Turkish daily rain gauge observation data has created a grid precipitation data set. The dataset will be used 1) to validate high resolution climate model output, 2) determine local impacts of global warming using statistical downscale methods combined with atmospheric patterns derived from a coarse general circulation model, and 3) diagnose hydrologic budget changes over Turkey and determine the impacts of both natural and anthropogenic climate change. Yatagai reports details of this data (in this volume).



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